

Planetary Forecaster
LS 4.1 & 4.2
How Do Land and Water Affect Surface Temperatures?

Read pages 96 and the first paragraph of page 97. Discuss with the class.

Get Started

Read the student ideas on the bottom of page 97 and then make a prediction about how land and water can influence temperatures on a planet. Record your prediction below.

Prediction

4.2 Investigate – Heating and Cooling of Land and Water

Predict – Read page 99 and record your predictions on the *Land & Water Temperature Data* page.

Procedure – Follow the procedure on page 99 and 100 to complete the lab. Record your observations on the data page.

Analyze Your Data

1. Draw a graph to show how the two materials heated and cooled. Plot time along the x-axis. Plot the temperature in half-degrees along the y-axis.

2. What trends do you see here?

a) What differences do you see in how much the sand and water heated?

b) What differences do you see in the time it took for the sand and water to heat?

c) What differences do you see in how much the sand and water cooled?

d) What differences do you see in the time it took the sand and water to cool?

3. Write a statement comparing the heating and cooling of sand and water.

4. Compare the results of your investigation with the prediction you made. Describe how the results are the same or different from your prediction.

5. Apply what you have learned from this investigation. Based on your data, which heats up more quickly during the day – land or water? Which cools more quickly at night – land or water?

Reflect

Look at the world map on page 102 and imagine it is June. Use the map to answer the following questions. Be prepared to share your answers with the class.

1. In June, what season is it at Locations 1 and 2 on the map?
2. Based on what you learned in the investigation, would you expect the temperature at Location 1 to be warmer or cooler than the temperature at Location 2? Why?
3. In June, what season is it at Locations 3 and 4?
4. Based on what you learned in the investigation, would you expect the temperature at Location 3 to be warmer or cooler than the temperature at Location 4? Why?

Communicate – Investigation Expo

Read the directions on page 102 and 103. Complete the poster with your group members.

What's the Point?

Planetary Forecaster

4.3

Why Do Some Substances Warm up Faster than Others

Read pages 104 – 107 and fill out the attached reading guide.

Define:

Specific heat capacity –

Stop and Think

1. It takes 0.214 calorie to raise the temperature of 1 gram of concrete 1°C. It takes 0.108 calorie to raise the temperature of 1 gram of iron 1°C. Which substance would cool down faster, concrete or iron?
2. Explain why the air over land is warmer during the day than the air over water.
3. Cities are made of bricks and cement. How do you think this affects the way cities heat and cool compared to country areas where there are not many buildings?
4. Which reflects more sunlight—dark soil or white sand?
5. Which substances listed in the table on the previous page absorb the most energy?
6. Explain why people who would like to stay cool on a hot summer day prefer to wear white clothing.
7. You are at the beach early in the morning, and the Sun glare makes you squint. What is happening to the light energy?
8. What Earth surfaces do you suppose reflect the greatest amount of light?

Explain

Create an explanation of how land and water bodies affect a planet's surface temperatures. Use a *Create Your Explanation* page. Share your explanations with the class.

Update the Project Board

You should describe what you learned from this reading and from the investigation in 4.2 and the evidence supporting that learning.

What's the Point?

Planetary Forecaster
4.4 Investigate
How Do Temperatures across Bodies of Land and Water Compare at Similar Latitudes?

Read page 109 and the map. Discuss with your group members different locations you have been to in the different bands.

Observe the map on page 110 and answer the two questions.

Predict – Read page 110 and make a set of predictions by completing the following sentences:

- At latitudes experiencing colder temperatures, or winter, you would expect the water to be (*colder than, warmer than, the same as*) the land.
- At latitudes experiencing warmer temperatures, or summer, you would expect the water to be (*colder than, warmer than, the same as*) the land.
- Near the Equator, you would expect the water to be (*colder than, warmer than, or the same as*) the land.

Procedure

Read the top of page 111 and then follow the directions for using the computer program. Follow the directions on page 113 to record data. Record your data on the data table below.

Northern Hemisphere Temperatures on January Map (season: _____)					
	Overall average (°F)	Land (°F)	Water (°F)	Land Difference (=land-average)	Water diff. (=water-ave.)
mid-latitudes (30°N-60°N)					
Tropics (0° - 30°N)					

Southern Hemisphere Temperatures on January Map (season: _____)					
	Overall average (°F)	Land (°F)	Water (°F)	Land Difference (=land-average)	Water diff. (=water-ave.)
mid-latitudes (30°S-60°S)					
Tropics					

(0° - 30°S)					
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Analyze Your Data

Using the table on the previous page summarize your findings by completing the following statements with temperature differences in °F, followed by “warmer” or “cooler.”

1. In *winter*, the temperature of the land farther from the Equator (with latitudes between 30°S – 60°S) will be _____ °F _____ than the average temperature. The temperature of land closer to the Equator (with latitudes between 0° – 30°S) will be _____ °F _____ than the average temperature.

2. In *winter*, the temperature of the water farther from the Equator (with latitudes between 30°N – 60°N) will be _____ °F _____ than the average temperature. The temperature of water closer to the Equator (with latitudes between 0° – 30°N) will be _____ °F _____ than the average temperature.

3. In *summer*, the temperature of the land farther from the Equator (with latitudes between 30°S – 60°S) will be _____ °F _____ than the average temperature. The temperature of land closer to the Equator (with latitudes between 0° – 30°S) will be _____ °F _____ than the average temperature.

4. In *summer*, the temperature of the water farther from the Equator (with latitudes between 30°N – 60°N) will be _____ °F _____ than the average temperature. The temperature of water closer to the Equator (with latitudes between 0° – 30°N) will be _____ °F _____ than the average temperature.

5. Which material stays closer to the overall average temperature at a particular latitude, land or water? Use evidence from your previous investigation, your readings, and this investigation to explain your answer.

6. How will this information affect your prediction for *Planet X*?

Conference

Share and discuss your answers with the rest of your group.

What's the Point?

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4.5
Review and Revise Your Explanation

In LS 4.3 you developed an explanation of how land and water bodies affect a planet's surface temperatures. It is now time to review your explanation and make changes based upon new information.

Before you revise your explanation, answer these questions. They will help you analyze the class explanation. You may use the answers to these questions as a guide in refining your explanation.

1. Describe how land and water differences affect temperature.

2. Describe your current understanding of how land and water differences affect temperature the way they do. Use evidence from your investigations to support your answer.

3. Complete a chart, similar to the one shown. Show how much land and water differences affect temperature. Show the differences between overall average temperature and land temperature in different locations on the planet during both winter and summer. Use your results from the previous section to help you. Also show the differences between overall average temperature and water temperature.

January		
Latitude band	Land difference (=Land - Average)	Water difference (=Water - Average)
30°N - 60°N (summer)		
0° - 30°N (summer)		
0° - 30°S (winter)		
30°S - 60°S (winter)		

January		
Latitude band	Land difference (=Land - Average)	Water difference (=Water - Average)
30°N - 60°N (summer)		
0° - 30°N (summer)		
0° - 30°S (winter)		
30°S - 60°S (winter)		

After completing the above charts and answering the questions you should be more prepared to revise your explanation. Use a *Create Your Explanation* page to rewrite your claim.

Update the Project Board

Focus on What are We Learning and What is Our Evidence?

Planetary Forecaster Back to the Big Challenge

Use your data from the previous investigations and your final explanation to update your prediction for the temperatures on *Planet X*. Once you have updated your prediction, modify your prediction of habitable areas on *Planet X*.

You will now use the My World program to update your prediction maps. Follow the procedure on pages 117 – 126.

Solution Briefing

Your *Solution Briefing* should focus on the following points:

- Present the general look of your solution. Explain where temperature differences appear on your map.
- Tell others how the data you collected and science content you learned during this *Learning Set* support your decisions about the temperature on *Planet X*.
- Discuss how the class explanation of land and water differences supports the solution you have created so far. If your map purposely does not match the explanation, tell your audience why this is so. Provide them with an explanation that better fits your idea.

Reflect

Answer the following questions. Be prepared to share your answers with your group and the class.

1. How did you use your land and water differences explanation to determine the temperature of *Planet X*?

2. How is the location/size of the habitable areas different than it was for shape and tilt? Why?

3. Think back to the initial list of factors. Identify the ones that have something to do with land and water differences. Describe how each of those factors would affect surface temperatures.

4. So far you have studied the effects of three major factors on surface temperature. You still need to study elevation. What do you think will happen to your possible habitable locations on *Planet X* before you make your final proposal to the CSA? Do you think they will get bigger, smaller, or stay the same?

